

JUNYANG CAI

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EDUCATION

University of Southern California

Ph.D. in Computer Science

Los Angeles, CA

Aug 2023 - Present

- Advisor: Bistra Dilkina
- Research direction: Machine Learning + Combinatorial Optimization, AI for Science

Bucknell University

B.S. in Computer Science & Engineering; B.A. in Mathematics

Lewisburg, PA

Aug 2019 - May 2023

- Overall GPA: 3.98 / 4.0
- Summa Cum Laude
- Member of Phi Beta Kappa, Omega Rho, Pi Mu Epsilon Honor Society

EXPERIENCE

Fidelity Investments

AI Center of Excellence

Boston, MA

June 2024 - Aug 2024

- Advisor: Serdar Kadioglu
- Project: BALANS: Multi-Armed Bandits-based Adaptive Large Neighborhood Search for Mixed-Integer Programming Problems

PUBLICATIONS

1. **Junyang Cai**, Serdar Kadioglu, Bistra Dilkina. BALANS: Multi-Armed Bandits-based Adaptive Large Neighborhood Search for Mixed-Integer Programming Problems. Under Submission.
2. **Junyang Cai**, Taoan Huang, Bistra Dilkina. Learning Backdoors for Mixed Integer Linear Programs with Contrastive Learning. *European Conference on Artificial Intelligence (ECAI)* 2024.
3. Jiatai Tong, **Junyang Cai**, Thiago Serra. Optimization Over Trained Neural Networks: Taking a Relaxing Walk. *International Conference on Integration of Constraint Programming, Artificial Intelligence, and Operations Research (CPAIOR)* 2024.
4. **Junyang Cai***, Nguyen Nguyen*, Nishant Shrestha, Aidan Good, Ruisen Tu, Xin Yu, Thiago Serra. Getting away with more network pruning: From sparsity to geometry and linear regions. *International Conference on Integration of Constraint Programming, Artificial Intelligence, and Operations Research (CPAIOR)* 2023.
5. **Junyang Cai**, Christopher M. Haggerty, Joshua V. Stough. Co-Unet-GAN: a Co-Learning Domain Adaptation Model on Echocardiography Segmentation. *Proceedings Volume 12464, Medical Imaging 2023: Image Processing*; 305-311.

* equal contribution

RESEARCH EXPERIENCE

Large Neighborhood Search for Mixed-Integer Programming

June 2024 - Present

Supervised by Serdar Kadioglu, Fidelity Investments

- Utilized Multi-armed Bandits algorithms to guide different large neighborhood heuristics for MIP problems
- Released BALANS as an open-source meta-solver that can be applied to any MIP problems
- Exploring contextual bandits algorithms and the parallelization of different configurations of BALANS

Machine Learning for Improving Mixed-Integer Programming Solver

Aug 2023 - Present

Supervised by Bistra Dilkina, University of Southern California

- Used graph attention network (GAT) and contrastive learning to make various decisions during the Branch and Bound algorithm inside the MIP solver
- Achieved more than 10% performance gain over the state-of-art commercial solver, Gurobi
- Exploring the direction of multitask learning and chaining these decisions together

Pruning Neural Networks Based on Linear Regions

Jan 2022 - May 2023

Supervised by Thiago Serra, Bucknell University

- Analyzed ways of pruning neural networks to increase their accuracy.
- Studied faster ways to approximate the linear regions in the neural networks and construct the upper bounds formula of linear regions for pruned networks.
- Performed neural network pruning based on the sparsity arrangement that leads to the highest upper bound and achieved better accuracy in both fully connected and convolutional neural networks.

Domain Adaptation on Echocardiography Segmentation

Sept 2021 - Feb 2023

Supervised by Joshua Stough, Bucknell University

- Used Convolutional Neural Networks to automatically segment echocardiography images, which can provide useful information and guide doctors to detect heart diseases.
- Trained the segmentation network and an image translation generative adversarial network (GAN) together to generalize performance across domains given supervised data only in the source domain.
- Obtained mean absolute error of 9.67% on our model outperforms a previously published model.

PRESENTATIONS

Oct 2023 (Oral) Getting away with more network pruning: From sparsity to geometry and linear regions. *INFORMS 2023*

Feb 2023 (Oral) Co-Unet-GAN: a Co-Learning Domain Adaptation Model on Echocardiography Segmentation. *SPIE Medical Imaging 2023: Image Processing*

AWARDS AND FELLOWSHIPS

2023 INFORMS 2023 Undergraduate Operations Research Prize Finalist

2023 Viterbi School of Engineering/Graduate School Fellowship

2023 The Bucknell Prize in Computer Science and Engineering

2022 Ciffolillo Healthcare Technology Inventors Program